

**Product Information TSM and TSB** **FOOD**

# Temperature Sensor

**Application/Specified usage**

- Temperature Measurement in vessels and pipes

**Application examples**

- Monitoring of CIP / SIP process
- Temperature monitoring in vessels

**Hygienic design/Process connection**

- Single piece Tri-Clamp® - no adapter required
- Product contact materials FDA compliant
- All stainless steel construction
- Conforms to 3-A Sanitary Standard 74-06; Third party verified

**Features/Advantages**

- Small package size
- Integrated transmitter - optional
- Multiple fitting choices

**Options/Accessories**

- Programmable transmitters with output 4-20 mA, 2-wire
- Programming adapter MPU-P 9701
- Integrated transmitter MPU-LCD with display in connecting head
- Connecting cable molded cordset available

**Authorizations**



**Temperature sensor TSB**



## Temperature Transmitter MPU-LCD with Display

**Application examples**

- In process monitoring with local display

**Features**

- 4-digit display with green backlight
- Temperature measurement in °C and °F
- Easy range select by one button
- Five Fahrenheit and five Celsius ranges pre-programmed and button selectable
- Display powered from loop, so lower costs for wiring because of 2-wire technology

**Note**

MPU-LCD Available Ranges - Button selectable  
 -10 to 40 °C, 0 to 50 °C, 0 to 100 °C, 0 to 150 °C and 0 to 200 °C  
 0 to 100 °F, 0 to 150 °F, 0 to 200 °F, 30 to 230 °F and 0 to 300 °F



**Option MPU-LCD (display in the connection head)**



General Specifications		
Process connection		Tri-Clamp®, NPT, NPT Spring Loaded and Thermowell
Materials	connecting head element and wettable surfaces	stainless steel 304 stainless steel 316L
Surface quality		$R_a \leq 25$ micro-inch, $R_a \leq 32$ micro-inch for thermowell fittings
Insertion length "A"		Minimum length dependent on fitting, maximum length 43½"
Operating pressure		145 psi (10 bar max)
Temperature ranges	ambient process CIP / SIP cleaning	-58...+176 °F (-50...+80 °C) -50...+350 °F (-45...+176 °C) 302 °F (150 °C) max. for 120 minutes (with transmitter)
Sensing resistor	acc. to DIN EN 60751	Pt100 Class A - 0.00385 $\Omega$ / $\Omega$ / °C
Electrical connection	cable gland cable connection	M16 x 1.5 M12-plug, 4-pins
Protection class	cable gland M12	IP 67 (with proper cable seal) IP 67 / IP69K

Transmitter MPU-4, MPU-M		
Temperature ranges	ambient storage	-40...+185 °F (-40...+85 °C) -67...+194 °F (-55...+90 °C)
Measuring ranges	MPU-4, MPU-M	standard: LRL, zero based, URL, consult matrix; special ranges free programmable
Accuracy	transmitter + element	$\pm 0.25$ °C + Pt100 Class A
Temperature drift	zero, span	< 0.01 % / K
Supply	MPU-M, MPU-4 accuracy	12-35 V DC 0.01 % / V (reference: 12 V DC)
Output	signal burden	analog 4-20 mA < 600 $\Omega$ (at $U_B = 24$ V)
Humidity	non condensing	0...98 %

Transmitter MPU-LCD		
Temperature ranges	ambient storage	-13...+185 °F (-25...+85 °C) -67...+194 °F (-55...+90 °C)
Measuring ranges	MPU-LCD	button selectable from one of ten pre-programmed ranges
Accuracy at 100 °C	transmitter display transmitter mA output	$\pm 0.5$ °C + Pt100 Class A (Display resolution $\pm 0.2$ °C) $\pm 0.4$ °C + Pt100 Class A
Repeatability, including hysteresis	input range: 100 °C	$\pm 0.2$ %
Temperature drift	zero, span	< 0.01 % / K
Supply	short circuit Rshunt = 500 $\Omega$	15-30 V DC 22-36 V DC
Output	signal burden	analog 4-20 mA < 600 $\Omega$ (at $U_B = 24$ V)
Humidity	non condensing	0...98 %
Output on failure	sensor break or short circuit	Short = output > 21 mA; Break = output < 3.6 mA
Electrical connection	cable connection	M12-plug, 4-pins

Accuracy class of temperature sensor (not including transmitter) | Tolerances for Pt100 - Compliant with DIN EN 60751

Temperature	Nominal reading	Class A element
32 °F (0 °C)	100.00 Ω	±0.08 F / ±0.06 Ω
212 °F (100 °C)	138.51 Ω	±0.19 F / ±0.13 Ω

Response time

5/32" diameter	1.75 to 2 seconds for 63% step change
1/4" diameter	2.5 to 3 seconds for 63% step change

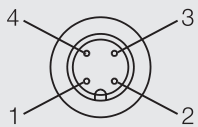
Note



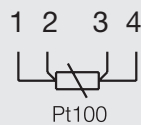
Response time for larger diameter probes as well as thermowell fittings is dependent on installation method, proper sizing to thermowell and specifications of thermal conductive paste.

Electrical connection without transmitter

With M12 plug

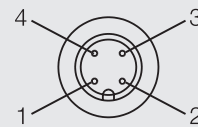


Configuration M12 plug



Electrical connection with transmitter

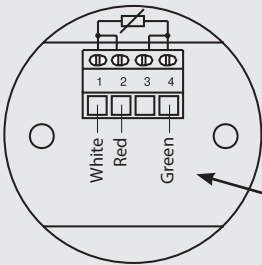
With M12 plug



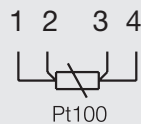
Configuration M12 plug

- 1: +supply
- 2: - supply 4-20 mA
- 3: not connected
- 4: not connected

With cable gland

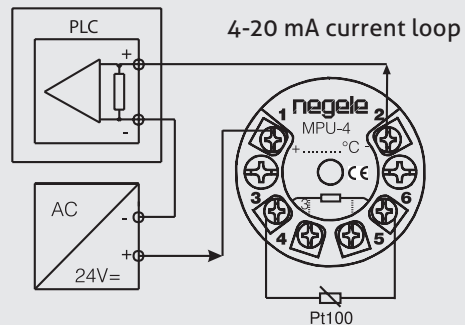


Configuration terminal strip



Typical Anderson-Negele Wiring Color Codes Shown

With cable gland



Meets 3-A Sanitary Standard 74-06 under the following conditions



- CIP / SIP cleaning - Maximum 302 °F (150 °C) / 120 min.
- Only with 3-A conforming Tri-Clamp® connection. (Not applicable to 1/2" Tri-Clamp®)
- Mounting position, self draining

EMC Guidelines

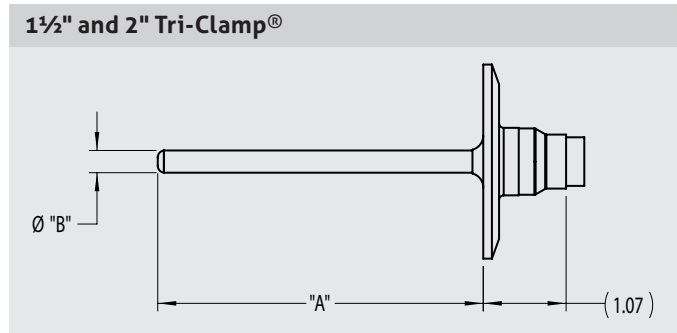
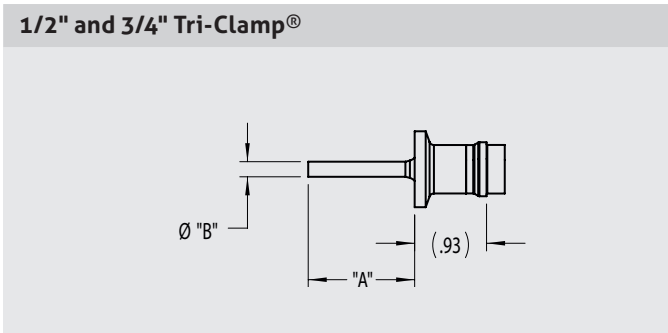
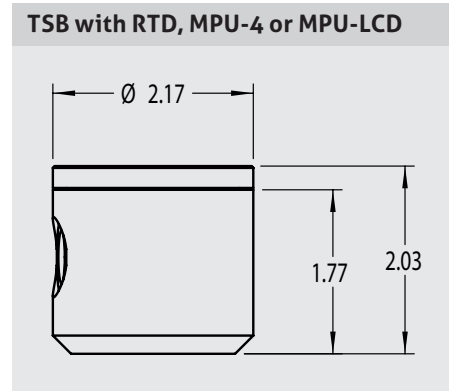
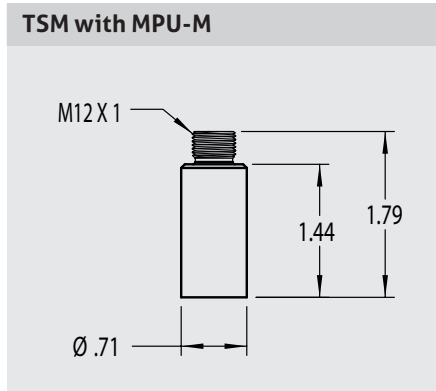
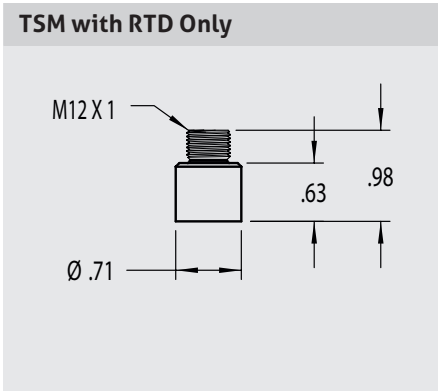


- The device agrees to following standards: EMC directive 2004/108/EC.
- End user must guarantee EMC directives are met for entire piece of equipment.

Conventional usage



- Not suitable for applications in explosive areas.
- Not suitable for applications in security-relevant equipments (SIL).

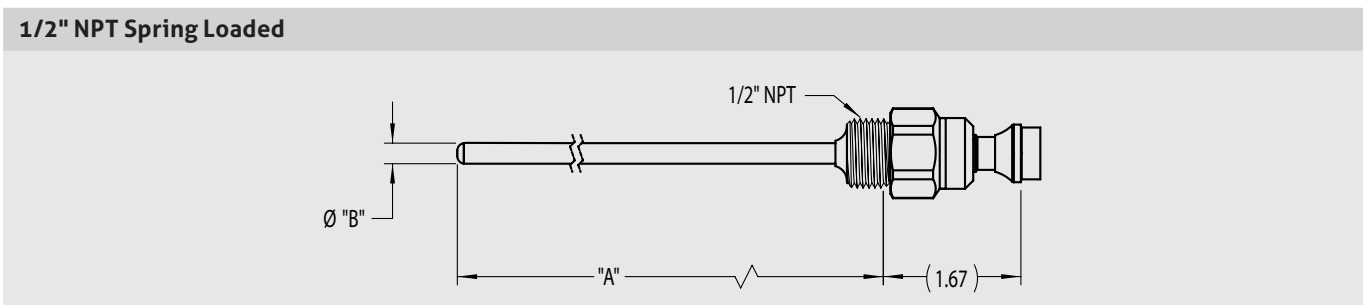


Dimensions table 1/2" and 3/4" Tri-Clamp®

Code	Description	Typical Length "A"	Dim. Custom Length "A"	Dim. "B"
001	1/2" Tri-Clamp®	1 1/8"	1 1/8" Min. - 6" Max	5/32"
002	3/4" Tri-Clamp®	1 1/4" and 2 3/4"	1 1/8" Min. - 6" Max.	5/32"

Dimensions table 1 1/2" and 2" Tri-Clamp®

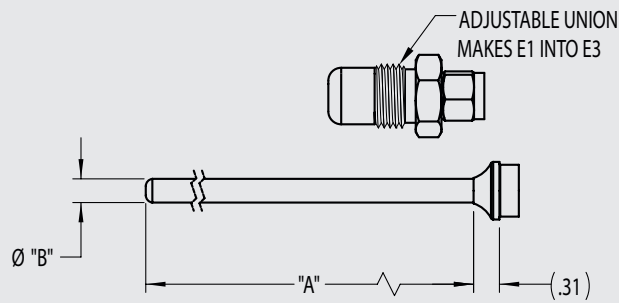
Code	Description	Typical Length "A"	Dim. Custom Length "A"	Dim. "B"
004	1 1/2" Tri-Clamp®	2 3/4"	1 3/4" Min. - 4 3/2" Max.	1/4"
		2 3/4"	2 3/4" Min. - 4 3/2" Max.	3/4"
005	2" Tri-Clamp®	3 1/2"	1 3/4" Min. - 4 3/2" Max.	1/4"
		3 1/2"	2 3/4" Min. - 4 3/2" Max.	3/4"



Dimensions table 1/2" NPT Spring Loaded

Code	Description	Typical Length "A"	Dim. Custom Length "A"	Dim. "B"
174	1/2" NPT - Spring Loaded	6" and 9"	2 3/4" Min. - 4 3/2" Max.	1/4"

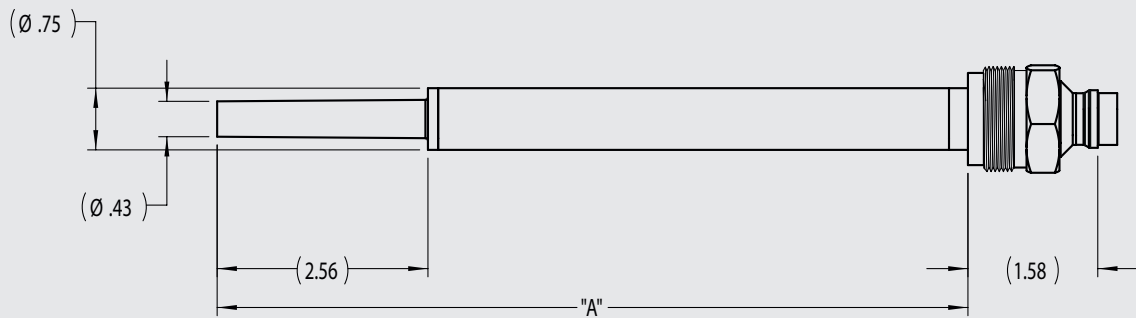
**E1 Plain Probe and E3 Plain Probe with Adjustable Union**



**Dimensions table E1 Plain Probe and E3 Plain Probe with Adjustable Union**

Code	Description	Typical Length "A"	Dim. Custom Length "A"	Dim. "B"
074	E1 - Plain probe	12"	4" Min. - 43½" Max.	1/4"
075	E1 - Plain probe	18"	4" Min. - 43½" Max.	3/8"
079	E3 - Probe with adjustable union	12"	4" Min. - 43½" Max.	1/4"
080	E3 - Probe with adjustable union	18"	4" Min. - 43½" Max.	3/8"

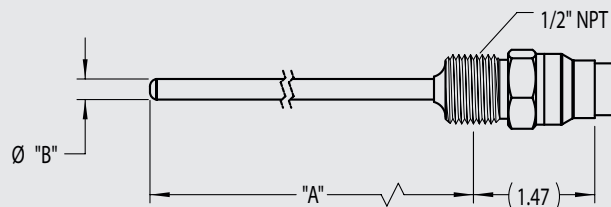
**Thermowell 41247**



**Dimensions table - Thermowell 41247**

Code	Description	Typical Length "A"	Dim. Custom Length "A"	Dim. "B"
062	Thermowell 41247	9½"	N/A	NA

**1/2" NPT**



**Dimensions table 1/2" NPT**

Code	Description	Typical Length "A"	Dim. Custom Length "A"	Dim. "B"
084	1/2" NPT	6" and 9"	2" Min. - 43½" Max.	1/4"

Order code

<table border="1" style="border-collapse: collapse; width: 100%;"> <tr> <td style="width: 10%;">T</td> <td style="width: 10%;">S</td> <td style="width: 10%;"></td> <td style="width: 10%;">U</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;">X</td> <td style="width: 10%;">1</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;">X</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> </table>	T	S		U				X	1					X							<p><b>MODEL</b></p> <p>M Mini B Conduit Housing DIN B</p> <p><b>FIXED CHARACTER</b></p> <p>U</p> <p><b>PROCESS CONNECTION</b></p> <p>001 1/2" Tri-Clamp® 002 3/4" Tri-Clamp®** 004 1½" Tri-Clamp®** 005 2" Tri-Clamp®** 062 Thermowell Well 41247 074 E1 Style - 1/4" Dia. 075 E1 Style - 3/8" Dia. 079 E3 Style - 1/4" Dia. (w/adj. union) 080 E3 Style - 3/8" Dia. (w/adj. union) 084 1/2" NPT 174 1/2" NPT Spring Loaded</p> <p><b>FIXED CHARACTER</b></p> <p>X</p> <p><b>RTD TYPE</b></p> <p>1 Single PT 100 - Class A</p> <p><b>INSERTION LENGTH - INCHES</b></p> <table border="0"> <tr><td>01 1"</td><td>13 13"</td><td>25 25"</td><td>37 37"</td></tr> <tr><td>02 2"</td><td>14 14"</td><td>26 26"</td><td>38 38"</td></tr> <tr><td>03 3"</td><td>15 15"</td><td>27 27"</td><td>39 39"</td></tr> <tr><td>04 4"</td><td>16 16"</td><td>28 28"</td><td>40 40"</td></tr> <tr><td>05 5"</td><td>17 17"</td><td>29 29"</td><td>41 41"</td></tr> <tr><td>06 6"</td><td>18 18"</td><td>30 30"</td><td>42 42"</td></tr> <tr><td>07 7"</td><td>19 19"</td><td>31 31"</td><td>43 43"</td></tr> <tr><td>08 8"</td><td>20 20"</td><td>32 32"</td><td></td></tr> <tr><td>09 9"</td><td>21 21"</td><td>33 33"</td><td></td></tr> <tr><td>10 10"</td><td>22 22"</td><td>34 34"</td><td></td></tr> <tr><td>11 11"</td><td>23 23"</td><td>35 35"</td><td></td></tr> <tr><td>12 12"</td><td>24 24"</td><td>36 36"</td><td></td></tr> </table> <p><b>INSERTION LENGTH - SIXTEENTHS (ALL NO CHARGE)</b></p> <table border="0"> <tr><td>00 0"</td><td>08 1/2"</td><td></td></tr> <tr><td>01 1/16"</td><td>09 9/16"</td><td>Max Length = 4308 (43½")</td></tr> <tr><td>02 1/8"</td><td>10 5/8"</td><td></td></tr> <tr><td>03 3/16"</td><td>11 11/16"</td><td>Min Length =</td></tr> <tr><td>04 1/4"</td><td>12 3/4"</td><td>See corresponding drawings</td></tr> <tr><td>05 5/16"</td><td>13 13/16"</td><td></td></tr> <tr><td>06 3/8"</td><td>14 7/8"</td><td>Common lengths =</td></tr> <tr><td>07 7/16"</td><td>15 15/16"</td><td>See corresponding drawings</td></tr> </table> <p><b>ROD DIAMETER</b></p> <p>20 5/32" 21 1/4" 22 3/8" 23 3/4" 24 41247 Well</p> <p><b>FIXED CHARACTER</b></p> <p>X</p>	01 1"	13 13"	25 25"	37 37"	02 2"	14 14"	26 26"	38 38"	03 3"	15 15"	27 27"	39 39"	04 4"	16 16"	28 28"	40 40"	05 5"	17 17"	29 29"	41 41"	06 6"	18 18"	30 30"	42 42"	07 7"	19 19"	31 31"	43 43"	08 8"	20 20"	32 32"		09 9"	21 21"	33 33"		10 10"	22 22"	34 34"		11 11"	23 23"	35 35"		12 12"	24 24"	36 36"		00 0"	08 1/2"		01 1/16"	09 9/16"	Max Length = 4308 (43½")	02 1/8"	10 5/8"		03 3/16"	11 11/16"	Min Length =	04 1/4"	12 3/4"	See corresponding drawings	05 5/16"	13 13/16"		06 3/8"	14 7/8"	Common lengths =	07 7/16"	15 15/16"	See corresponding drawings	<p><b>CABLE CONNECTION</b></p> <p>0 Cable Gland (For model B only) 1 M12 Connector (Must choose with MPU-LCD and model M)</p> <p><b>UNIT</b></p> <p>0 RTD Only 1 MPU-LCD (Field Select) F Fahrenheit C Celcius</p> <p><b>UPPER RANGE</b></p> <p>000 RTD Only 111 MPU-LCD (Field Select) 050 50 °C Only 060 60 °C Only 100 100 °F or C 150 150 °F or C 180 180 °C Only 200 200 °F or °C 250 250 °F Only 300 300 °F Only XXX Special Range</p> <p><b>TRANSMITTER</b></p> <p>0 RTD Only 1 MPU-M (For model M only) 2 MPU-4 (For model B only) 4 MPU-LCD (For model B only)**</p>
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\* Conforms to 3-A standards 74-06  
\*\* Probes 12" and under only

Adapters for E3 Adjustable Union  
(Converts NPS thread to NPT thread)

29057A0001  
Converts Adj. Union > 1/2"-14 NPT

29057A0002  
Converts Adj. Union > 3/4"-14 NPT

Molded cordset, PVC with M12 connection, NEMA 4X / IP 68 / IP69K

- 42117H0025 PVC-cable 5-pin, length 25'
- 42117H0050 PVC-cable 5-pin, length 50'
- 42117H0100 PVC-cable 5-pin, length 100'

**Note:** Pin 5 not used



Programming adapter MPU-P 9701



Programming adapter for MPU-4 and MPU-M (Requires PC with USB serial port)